BMC Neuroscience

Poster presentation

Open Access

RTBiomanager: a software platform to expand the applications of real-time technology in neuroscience

Carlos Muñiz*, Francisco de Borja Rodríguez and Pablo Varona

Address: Grupo de Neurocomputación Biológica. Dpto. de Ingeniería Informática. Universidad Autónoma de Madrid. 28049 Madrid, Spain

Email: Carlos Muñiz* - carlos.muniz@uam.es

* Corresponding author

from Eighteenth Annual Computational Neuroscience Meeting: CNS*2009
Berlin, Germany. 18–23 July 2009

Published: 13 July 2009

BMC Neuroscience 2009, **10**(Suppl 1):P49 doi:10.1186/1471-2202-10-S1-P49

This abstract is available from: http://www.biomedcentral.com/1471-2202/10/S1/P49

A grand challenge in Computational Neuroscience is the integration of data arising from experimental techniques and theoretical work that involves large regions of unconstrained parameter space. Neural systems have drift, adaptation and learning mechanisms that result in transient behavior. Many information-processing mechanisms take place in this nonstationary activity that extends over several spatial and temporal scales. Studying this type of activity requires the use of activity-dependent stimulation techniques that can probe transient input/output relationships of neurons and circuits over different timescales (including under the millisecond). This requirement points towards the creation of new real-time software protocols to perform closed-loop adaptive interaction with neural systems to observe, manipulate and actively probe their function. These protocols may include the use of models that interact with living neurons to constrain their parameter space and even to refine themselves through this interaction [1]. RT activity-dependent stimulation can involve many types of stimuli (electrical, chemical, mechanical, etc.) and monitoring techniques (intra- or extracellular recordings, imaging, etc).

Here we present RTBiomanager, a real-time software platform that can help to study neural transient dynamics. This platform can be used to build activity-dependent stimulus-response loops to interact with living systems below the millisecond time scale. So far, RT technology has been used to introduce artificial membrane or synaptic conductances and to create hybrid circuits of real and electronic neurons [2-4]. Generalizing the principles underlying dynamic-clamp, new protocols of RT event-dependent control, stimulation, and recording can be developed with applications in a broad spectrum of biomedical research. RTBiomanager is a multipurpose platform to control bi-directional interactions among living RT agents and artificial RT agents. Examples of living RT agents are cells, neurons, membranes, synapses, neural network and tissues. Examples of artificial RT agents are computer models, electronic devices, artificial neurons, sensors, microinjectors, motors [5], lasers and CCD cameras. RTBiomanager runs under RTAI (Real-Time Application Interface), a hard real-time layer over the Linux operating system to assure that the timing constraints in the detection, stimulation and control of artificial RT agents involved in physiological experiments can be accomplished.

RTBiomanager is a user-friendly and customizable application that provides its own data monitor and analysis tools. This platform is designed for neuroscientists to explore the use of real-time technology to build a set of novel experiments that combine different recording and stimulation techniques. RTBiomanager will be available for free to download from our webpage.

Acknowledgements

This work was supported by MEC PHB2007-0013TA, BFU2006-07902/BFI, TIN 2007-65989 and CAM S-SEM-0255-2006.

References

1. Nowotny T, Levi R, Selverston AI, Nowotny T, Levi R, Selverston AI, Nowotny T, Levi R, Selverston AI: **Probing the dynamics of identified neurons with a data-driven modeling approach.** *PLoS ONE* 2008, **3:**e2627.
2. Muniz C, Arganda S, Rodriguez FB, de Polavieja GG, Varona P: **Realistic stimulation through advanced dynamic clamp protocols.** *Lect Notes Comput Sci* 2005, **3561:**95-105.
3. Sharp AA, O'Neil MB, Abbott LF, Marder E: **Dynamic clamp: computer-generated conductances in real neurons.** *J Neurophysiol* 1993, **69:**992-995.
4. Nowotny T, Szucs A, Pinto RD, Selverston AI: **STDPC: A modern dynamic clamp.** *J Neurosci Methods* 2006, **158:**287-99.
5. Muniz C, Levi R, Benkrid M, Rodriguez FB, Varona P: **Real-time control of stepper motors for mechanosensory stimulation.** *J Neuroscience Methods* 2008, **172:**105-111.